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INTERNATIONAL

JANUARY 1951

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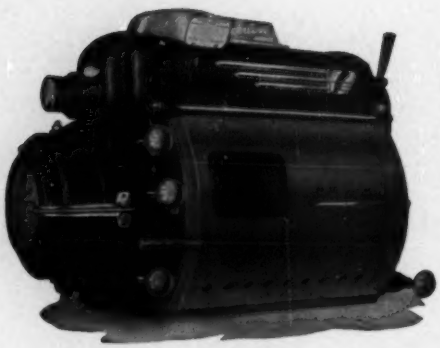

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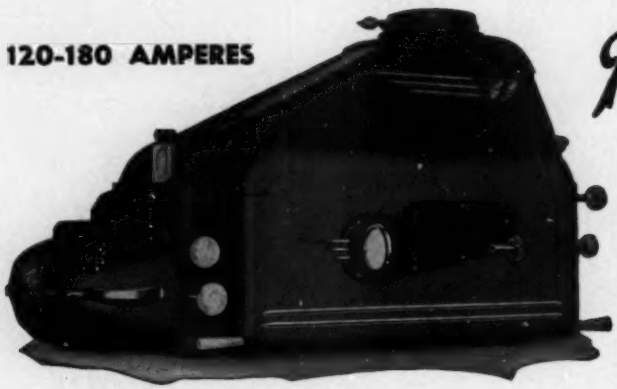

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HENRY B. SELLWOOD, *Editor*

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MONTHLY CHAT

IT'S ironic that when film exhibitors finally got around to effecting some degree of cohesion and displaying a bit of spunk with respect to a go-ahead on theater Tv, the defense needs of the country became so acute as to render their efforts futile. The same degree of courage and savvy, if evidenced two or more years ago, might have created a situation wherein the exhibition field today would be in a strong spot to battle the inroads of network Tv upon the box-office take.

It is all very well to announce that theater Tv will be installed in 71 houses of a given circuit—as both RCA and Fox West Coast Theaters did in recent weeks—but it is quite something else to gain this goal when one stops to ponder the amount of critical defense items that necessarily would be included in this number of units.

It is not our intent to disparage the forward-looking stand of both RCA and the exhibition group, but it seems a pity that such aggressive action could not have been taken many months ago at a time when the FCC was disposed to look with favor on the expansion of a theater Tv chain. The present time, which sees even run-of-the-mill items severely restricted in favor of defense needs, seems hardly the time to announce the creation of a theater Tv setup involving upwards of a hundred units—just as a start.

It is barely possible that the international situation will suddenly take a turn for the better; but even if this near-miracle should eventuate, it is sheer nonsense to suppose that Uncle Sam would cut drastically his rearmament program. It seems certain that we face at least three years of equipment scarcities, with the motion picture theater slated to enjoy no particular favors from Uncle Sam.

The situation is rather a tough one for projectionists to accept with equanimity, because the craft has gone along month after weary month in the hope that exhibitors would bestir themselves and really take positive action anent theater Tv. Alas, it was not to be.

For the present, therefore, projectionists must mark time and nourish the hope that somehow the theater field will be permitted enough leeway to erect a bulwark against those forces now threatening the box-office. That the craft will do more than its full share in the materials conservation program goes without saying. For the rest, it can only grimly get on with its work and hope for the best.

And we hope that this time the contributions of the organized crafts will not be overlooked when the kudos are handed out to the industry.

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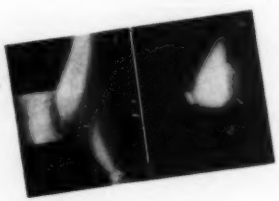

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Maintenance and Servicing of Motors

By ROBERT A. MITCHELL

III. Trouble-Shooting Charts

BEFORE attempting to diagnose motor troubles the projectionist should make certain of the type and specifications of the motor. This information is usually given on the nameplate of the motor.

(1) Manufacturer's name.

(2) Serial number. This number is necessary when ordering parts.

(3) Type of motor, which may be D.C. (shunt, series, or compound); "universal A.C.-D.C.; synchronous, or induction. Induction motors of the single-phase type are usually described as "split-phase," "capacitor," or "repulsion-induction" motors, depending upon the principle utilized for starting.

(4) Phase. Most motors designed for operation on A.C. are single-phase and 3-phase.

(5) Cycles: 25, 50, or 60 cycles.

(6) Volts: line voltage should be within 10% of the rated voltage.

(7) Horsepower. Motors rated at ⅛, 1/6, 1/5, ¼, 1/3, ½, and ¾ H.P. are known as "fractional horsepower motors."

(8) R.P.M. refers to the speed in revolutions per minute.

Explanation of Indicia

In addition to these data, certain other information is sometimes given on the nameplate. The model and the order numbers of the motor, for example. Temperature-rise rating is a guarantee that the motor will not get hotter than room temperature *plus* the stated temperature rise, if correctly operated and not overloaded. The rise rating for most "open" motors is 40° C. (104° F.), or 50° C. (122° F.) Such a motor may feel decidedly warm to the hand, but not uncomfortably hot. Many "enclosed" motors have a rating of 55° (131° F.) rise.

The term "open" on a nameplate means that the end brackets have openings and that the rotor shaft has vanes affixed to draw cool air over the windings and expel the heat generated. Such a motor should not be housed in an airtight compartment, as this would lead to overheating of the motor.

Obtain, if possible, the manufacturer's instructions for lubricating and servicing each type of motor used in the projection room, generator room, and backstage.

The bearings are more subject to wear than any other part of a motor, and hence should be periodically inspected according to the schedule previously given. The condition of sleeve bearings is in a large measure indicated by the air gap between stator and rotor pole-pieces. Worn bearings will lower the rotor, and may even allow the rotor to strike against the stator. Ball bearings should be checked for heating and noisy operation.

Commutators and brushes are involved in the servicing of D.C., universal, and repulsion-induction motors.

Grooved and lop-sided commutators must be "trued" in a lathe, but minor irregularities may be removed by using a small commutator stone or 00 sandpaper wrapped on the end of a stick and applied to the commutator while the motor is running. (Never use emery paper on commutators!) The mica insulation between the commutator bars should be undercut about 1/16 inch, as copper wears faster than mica. A steel slotting tool is used for undercutting, and a V tool for giving the edges of the copper bars a very slight bevel. After the mica slots have been cleaned, the mica surfaces should be coated with glossy red enamel of the iron oxide or synthetic type.

A commutator is "dressed" by cleaning with a dry rag, applying a small amount of vaseline to the copper bars with a clean rag, and then wiping off the vaseline. When in good condition, a commutator will have a chocolate-brown color due to an extremely thin film of copper oxide. The carbon of the brushes and the oxygen of the air help maintain this desirable brown coating.

All brush rigging must be kept clean and in good working order. The tension of the brushes (about 1½ pounds per square inch of brush surface) must be checked occasionally. Too much tension may cause chattering and rapid grooving of the commutator. The pigtail connections must be tight.

Care in Brush Selection

The importance of using the right type and grade of brush for each motor cannot be overemphasized. The brush material, whether graphite, electrographite, metal graphite, carbon graphite, or hard carbon, must have adefinite resistance in ohms per cubic inch, a certain current-carrying capacity in amperes per square inch of brush face, and a specified contact area. New brushes may be shaped to fit the curvature of the commutator by placing a strip of sandpaper on the commutator and working back and forth while the brush is pressed down upon it.

Further servicing information is sup-

plied by the accompanying trouble-shooting listings. These summaries give data for D.C. and "universal" motors, for polyphase induction motors (the type of motor most often used in 3-phase motor-generator sets), and for all single-phase induction motors. Most A.C. projector motors fall into the last-named class.

1. BEARINGS TOO HOT

Trouble: Bearing dry. *Cause:* Insufficient lubrication, or the wrong lubricant. *Remedy:* Clean bearings and refill with fresh oil or grease of the type recommended by the manufacturer of the motor. On small motors, examine and clean felt wipers.

Trouble: Bearing dirty. *Cause:* Dust or dirt in oil or grease. *Remedy:* Clean out oil or grease reservoir and refill.

Trouble: Tight bearing. *Cause:* Insufficient lubrication, or undersized bearing, if bearing has been replaced. *Remedy:* Provide lubrication. Polish shaft with fine emery paper, or replace bearing.

Trouble: Bearing binding. *Cause:* Shaft "sprung," or too much strain on pulley. *Remedy:* "True" the shaft in a lathe and renew bearing in any case.

Trouble: Loose bearing. *Cause:* Vibration and wear. *Remedy:* Tighten screws holding bearing. Replace worn bearing.

2. ENTIRE FRAME TOO HOT

Trouble: Transference of heat from bearings or armature. *Causes and Remedies:* See Causes and Remedies under 1 and 3.

Trouble: Transference of heat from field coils. *Cause:* Overload, too much current, or shorted coils. *Remedy:* Decrease load or increase size of motor. Operate motor on correct voltage. Replace defective field windings with new ones.

When operating on D.C., a short-circuited field coil is cooler than those adjacent to it. On A.C., the short-circuited coil is hotter than those adjacent to it, and may even smoke. If difficulty is experienced in locating the short-circuited coil, impress full voltage across the windings and test the magnetic pull of each coil with a screwdriver. The coil in which the magnetic pull is least is the shorted one.

3. ARMATURE TOO HOT

Trouble: Overload. *Cause:* Driven machine binding, or motor too small. *Remedy:* Correct mechanical defects or use larger motor.

Trouble: Armature out of center between poles. *Cause:* Worn bearings. *Remedy:* Replace bearings.

Trouble: Moisture in coils. *Cause:* Operating in a damp place. *Remedy:* Dry out by baking in warm oven or running with no load. Improve operating conditions.

4. SPARKING OF BRUSHES

Trouble: Brushes not properly set with regard to the field winding. *Cause:* Misadjustment of brushes, or end-bell shifted to wrong position. *Remedy:* Shift the brush-holders or end-bells.

The brush position on universal motors of small size is fixed by the manufacturer, and cannot be changed. On the types where the end-bells can be shifted, there are holes through which the bolts holding the end-bells pass. This trouble is not likely to be encountered except when the motor has been taken apart and carelessly assembled.

Trouble: Brushes cover too many commutator bars. *Cause:* Brushes too thick. *Remedy:* Use brushes of proper thickness. Replace brush-holders if they show signs of wear.

Trouble: Brushes too short. *Cause:* Wear. *Remedy:* Replace with new brushes.

Trouble: Poor contact between brush and commutator. *Cause:* Oil or dirt on commutator. Grit in brush. *Remedy:* Clean commutator with dry rag, then "dress" it with a mere trace of vaseline. Use brushes of better quality.

Trouble: Rough or uneven commutator. *Cause:* Vibration, different quality of bars, and uneven ridges where brushes do not wear the commutator. *Remedy:* If the trouble is slight, the roughness may be removed with a commutator stone or 00 sandpaper (NOT emery paper). Otherwise the commutator should be trued in a lathe.

Trouble: High, low, or loose bars. *Cause:* Clamping cone loose. Commutator mishandled. *Remedy:* Press the high bars back into place, raise the low bars, carefully tighten locknut or set-screws, and finally true the commutator in a lathe.

Trouble: High mica. *Cause:* Commutator wear. (Copper wears faster than mica.) *Remedy:* With a sharp steel tool undercut the mica below the level of the copper bars. Wipe free of dust and dress the commutator.

Trouble: Weak magnetic field. *Cause:* Short circuit in field windings. *Remedy:* Replace defective coils. (See fine-print note under Symptom 2.)

Trouble: Excessive current in armature. *Cause:* Load too great for size of motor. *Remedy:* Reduce load or obtain larger motor.

Trouble: Grounds in armature or commutator. *Cause:* Defective insulation. *Remedy:* Remove ground if possible or, if not, cut out the grounded coil and bridge grounded commutator bar. (The grounded coil should be rewound, or the armature replaced, at the earliest opportunity.)

Trouble: Short circuit in armature. *Cause:* Defective insulation. *Remedy:* As a temporary expedient, cut out short-circuited coil and bridge across the commutator bar involved.

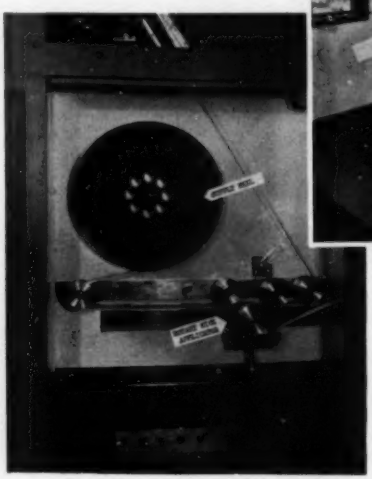
Trouble: Commutator bars short circuited; mica worn or chipped away, causing deep pits between bars. *Cause:* Copper or carbon dust between commutator bars, or melted solder from leads between the bars. *Remedy:* Remove foreign matter from between bars and paint the exposed mica insulation with glossy red enamel of the iron oxide or synthetic type.

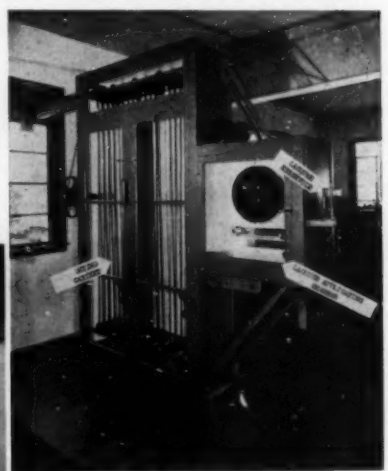
5. BRUSHES SING

Trouble: Brush pressure too great. *Cause:* Brush-holder springs not properly

Lacquer Coating for Cine Film

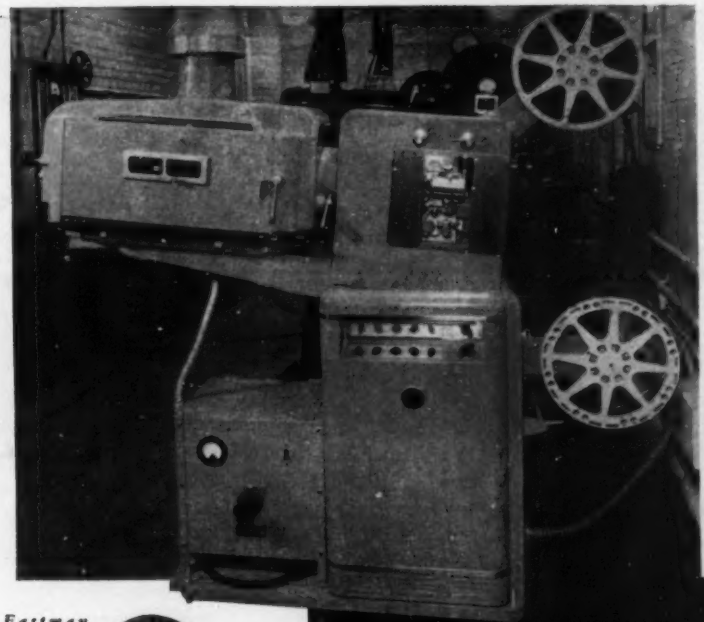
Equipment used to preserve valuable film subjects and effect tremendous savings in print costs (IP for Dec., 1950, p. 14).





Corner of Escar's motion picture laboratory, showing lacquer coating machine for 16- and 35-mm films. Controlled heat and filtered air quickly dry coated film.

Glass-enclosed dustproof lacquer applicator is shown at left. As film leaves supply reel, it travels over rotary applicator which deposits thin coat of lacquer on film surfaces.



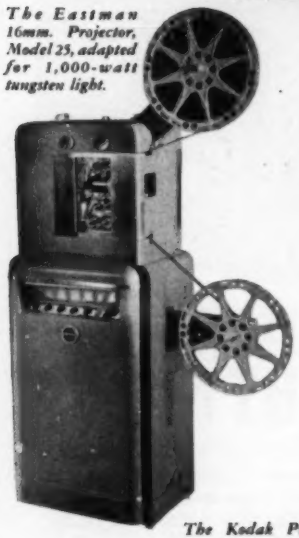
Left, the Eastman 16mm. Projector, Model 25, brings 16mm. projection to the professional level. Shown here, adapted for arc illumination, permanently installed alongside 35mm. equipment.

Below, working parts of the film movement mechanism are in constant view of the operator . . . readily accessible for threading and cleaning.

Engineered to the Most Exacting Professional Standards

The Eastman 16mm. Projector, Model 25

The Eastman 16mm. Projector, Model 25, adapted for 1,000-watt tungsten light.



The Kodak Projection Ektar Lens, in a choice of four focal lengths, insures superior screen image.

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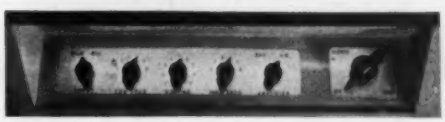

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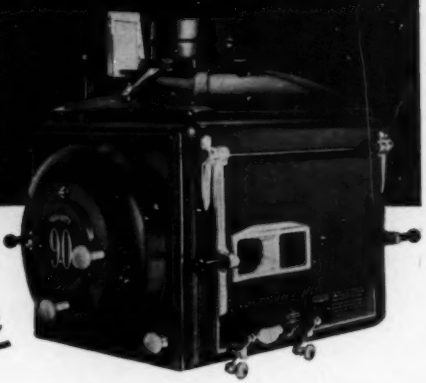

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adjusted. *Remedy:* Remove part of the brush tension.

Trouble: Brushes of the wrong type used. *Cause:* Brushes probably too hard. *Remedy:* Use brushes recommended by the manufacturer of the motor. In lieu of this information, try graphite brushes to eliminate singing.

Trouble: Dirty commutator. *Cause:* Improper dressing of commutator, dust and dirt from air, over-oiling of motor. *Remedy:* Clean commutator with dry rag, then rub a small quantity of vaseline on the commutator with a clean rag, and finally wipe off the commutator. (A properly dressed commutator will have a thin chocolate-brown film of copper oxide.)

6. BRUSHES CHATTER

Trouble: High bars. *Cause:* The cone or V-ring holding bars in place loose. *Remedy:* Carefully drive high bars back into place and tighten cone at end of commutator. Smooth commutator with stone or 00 sandpaper, or true in a lathe.

Trouble: Low bars. *Cause:* Wearing away due to soft bars or short-circuited coils. *Remedy:* Loosen cone and lift low bars. If mica insulation of cone is cut through, replace to avoid short-circuiting of commutator. True commutator in a lathe.

Trouble: High mica. *Cause:* Commutator worn. (Copper wears faster than mica.) *Remedy:* By means of a sharp steel tool, cut mica about 1/16 inch below level of bars. Clean the commutator, paint the mica insulation with glossy red enamel of the iron oxide or synthetic type, and finally, when the enamel is dry, dress the commutator with a trace of vaseline.

Trouble: Loose bars. *Cause:* Cone or V-ring loose. *Remedy:* Even up the bars and tighten the cone. As a safeguard, test commutator for grounds with any circuit-testing device. True the commutator in a lathe.

7. ARMATURE MAKES CLICKING OR POUNDING SOUNDS

Trouble: Armature striking or rubbing pole pieces. *Cause:* Worn bearings. *Remedy:* Replace bearings.

8. MOTOR FAILS TO START

Trouble: Load too great. *Cause:* Motor too small for load, bearings too tight, or driven machinery binding. *Remedy:* Use motor of proper capacity. Polish shaft with emery cloth. Inspect driven machinery, and disconnect load to see if motor runs light.

Trouble: Open circuit in line. *Cause:* Fuse blown. Wires broken or disconnected. *Remedy:* Replace fuse. Examine line and connections, and restore circuit. Open up motor leads, and test both line and motor leads.

Trouble: Open circuit in field or field connections. *Cause:* Disconnected or broken wires; burned-out coil. *Remedy:* Test field connections with circuit tester.

Trouble: Open circuit in armature. *Cause:* Broken wire, burned coil. *Remedy:* Test adjacent commutator bars with circuit tester. Bridge over open coil as temporary expedient, later replacing armature.

Trouble: Short circuit in field. *Cause:* Defective insulation or, rarely, dampness. *Remedy:* If the insulation is defective, the field will have to be rewound. This is especially the case when the motor has been exposed to a film fire. Bake the field windings if damp.

Trouble: Brushes not in contact with commutator. *Cause:* Brushes fit too tightly in holders. *Remedy:* Clean the holders, and adjust brushes so that they work easily.

Trouble: Faulty commutation. *Cause:* Brushes not set on neutral point. *Remedy:* On some motors, move end-bells; on a few types, move stator core inside frame. (This trouble will not occur unless the motor has been taken apart and wrongly assembled.)

9. MOTOR RUNS BACKWARD

Trouble: Reversed connection. *Cause:* Field or armature connections wrongly made; end-bell shifted 90 degrees in compensated motors. *Remedy:* If operated on D.C., reverse either the field or the armature connections. Do the same with straight series universal motors operated on A.C. In motors having compensating windings, shift the end-bell 90 degrees.

[To be Continued]

French Film Theater Equipment

As of July 1 last, there were 5145 theaters with 35-mm equipment operating in France, with a total seating capacity of 2,475,177. There were also about 1250 theaters or halls operating with 16-mm equipment.

With the renewed availability of materials, as well as the aid granted by the Government toward the refurbishing of theaters, pre-war French, U. S. and other foreign equipment is gradually being replaced, almost entirely by new French equipment. In general, however, equipment is badly worn, much of it is still pre-war. Exchange restrictions render the opportunity for U. S. equipment practically non-existant.

Old, New Equipment Display a Good Exploitation Stunt

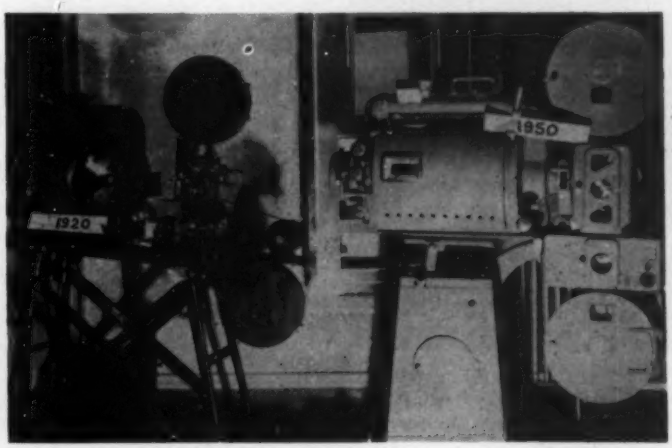
DISPLAYS of new and old projection equipment in dealers' store windows are not uncommon, and even theater lobbies have exhibited replicas of new equipment that has been installed. Seldom, however, is there a display of the new and the old in theater lobbies as an exploitation move designed to direct attention to the great technological strides forward that have been made within the past three decades, or prior to the introduction of sound pictures.

Just such an unusual display was staged recently at the Astoria Theater, Chippenham in Wiltshire, in the west of England. For the recent opening of his provincial-town theater, D. Shield, manager, arranged a display of various types of projection equipment, ancient and modern. The accompanying illustration shows a corner of this display in which is set up an "ancient" 1920 model projector—the openwork, dirt-collecting type—and the latest Westrex sound system and associated equipment.

The photo is reproduced here through the cooperation of H. B. Allinsmith, managing director of Westrex Corp. of England.

This stunt should commend itself to supply dealers and exhibitors everywhere as a most interesting exhibit for the average theatergoer, particularly those men who are mechanically minded and who seldom, if ever, have had an opportunity to inspect a modern sound projection outfit. It follows, of course, that any such effort should have the unstinted cooperation of the projectionist craft.

Set-up for old and new projection equipment an effective lobby display.



Theater Television

via the RCA PT-100 Equipment

By TECHNICAL PRODUCTS DIVISION, RCA SERVICE CO., INC.

II. Tracing the Signal Through the Equipment

IN LOCATIONS where a standard broadcast television signal of good quality and ample strength is available, and noise interference is negligible, it will occasionally be desirable to use such broadcast signal as program source. To enable this to be readily accomplished, a specially constructed receiver is built into the RCA PT-100 Tv projector. This receiver is capable of reception on any of the 12 standard Tv broadcast channels.

When maximum performance for air pickup is required, a separate, highly directional antenna may be installed for each channel desired, and a plug-and-jack switchboard installed near the Tv projector control rack to allow selection of antenna for connection to the receiver.

RCA PT-100 THEATER Tv UNITS

Top: Projector Control panel.
Bottom: Video-audio switching panel.

Program Selection Switching

The PT-100 theatre Tv projector is provided with twin interlocking pushbutton switches to permit the projectionist to select his program material from either of two incoming lines, or to instantaneously change from one line to the other. The pushbuttons are interlocked so that pushing either will release the other, if it has been previously depressed. This prevents mixing the two incoming programs, which would occur if both buttons were depressed simultaneously.

One pair of these switches is for sound signal input and one pair for video signal (picture) input. The equipment is shipped from the factory with the sound and picture signal outputs of the Tv receiver connected respectively to line No. 1 audio switch and line No. 1 video switch. When these two buttons are pushed, these outputs of the Tv receiver are connected to the projector.

Video signal from a coaxial line or an UHF radio relay link can be connected to video line No. 2, and its corresponding sound to audio line No. 2. When these two buttons are pushed, coaxial line signal will be fed into the projector.

When either one of the two "projector audio" buttons is pushed, sound signals from the corresponding input line are fed to the audio volume control, which is located on the projector control panel. From the output of the audio volume control, the sound signals pass into a special input switch connected to the regular theatre sound system. Here they are amplified and sent to the regular stage speakers just as in the reproduction of sound from film.

The audio volume control on the projector control panel is provided to allow the operator to properly adjust the sound volume in the auditorium without leaving the Tv projector control rack.

An "audio monitor jack" is located on the signal selector panel. This permits headset monitoring of the incoming audio signal on either line, merely by pressing the corresponding audio monitor button, *regardless of whether one of the audio projector buttons is depressed.* The two monitor buttons also are interlocked so that pressing one releases the other.

Path of Video Signal

The video signal coming from the receiver (line No. 1) or from the coaxial cable or UHF beam line (line No. 2), whichever is selected by the projector video pushbuttons, then goes through a pre-amplifier and to the video gain control. This control is located on the projector control panel, at the left of the audio gain (volume) control. This control allows the operator to adjust the brightness of the white picture areas on the screen to obtain proper contrast.

From the video gain control, the video signal goes through coaxial cable to the video amplifier in the projector barrel located in the auditorium. Here the signal is amplified to high enough voltage to fully control the beam current of the 7NP4 projection Kinescope. This output voltage is then applied to the control electrode of the Kinescope, where it varies the current in the electron beam, and thus the brightness of the light spot on the Kinescope face, while this spot is being swept electronically across the tube face to produce the picture.

To enable the operator to see the picture before it is put on the screen, and to check on the operation of the video amplifier, a video monitor is provided on the monitor rack. This contains a 7-inch Kinescope, with associated equipment. A set of three interlocking pushbuttons is provided on the signal selector panel. Pushing the appropriate button connects the video monitor input to incoming line No. 1, incoming line No. 2, or, through a coaxial cable, to the output of the video amplifier in the projector barrel. The monitor Kinescope and the 7NP4 Kinescope in the auditorium projector therefore show the same picture.

Of course, if no video signal is being fed to the video amplifier, or if the amplifier for any reason is inoperative, the monitor will show this fact by lack of

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BOSTON—J. Cifre, Inc.; Nat'l Theatre Supply Co.
BUFFALO—Dion Products; Nat'l Theatre Supply Co.
CHARLOTTE—Nat'l Theatre Supply Co.; Standard Theatre Supply Co.
CHICAGO—Abbott Theatre Equipment Co.; Gardner Jansen, Inc.; Hollywood Stage Lighting Co.; Midwest Stage Lighting Co.; Midwest Theatre Service and Equipment Co.; Nat'l Theatre Supply Co.
CINCINNATI—Nat'l Theatre Supply Co.
CLEVELAND—Nat'l Theatre Supply Co.
DALLAS—Hardin Theatre Supply Co.; Modern Theatre Equipment Co.; Nat'l Theatre Supply Co.
DENVER—Nat'l Theatre Supply Co.; Graham Bros.
DES MOINES—Nat'l Theatre Supply Co.
DETROIT—Nat'l Theatre Supply Co.
FORTY FORT, PA.—V. M. Tate Theatre Supplies
GREENSBORO, N. C.—Standard Theatre Supply Co.
HOUSTON—Southwestern Theatre Equipment Co.
INDIANAPOLIS—Nat'l Theatre Supply Co.
KANSAS CITY, MO.—Shreve Theatre Supply; Nat'l Theatre Supply Co.
LOS ANGELES—J. M. Boyd; C. J. Holzmueller; Nat'l Theatre Supply Co.; Pembrex Theatre Supply Corp.
LOUISVILLE—Falls City Theatre Supply Co.
MEMPHIS—Nat'l Theatre Supply Co.
MILWAUKEE—Nat'l Theatre Supply Co.; R. Smith Co.
MINNEAPOLIS—Minneapolis Theatre Supply; Nat'l Theatre Supply Co.
NEW HAVEN—Nat'l Theatre Supply Co.
NEW ORLEANS—Nat'l Theatre Supply Co.
NEW YORK CITY—Nat'l Theatre Supply Co.
NORFOLK—Nat'l Theatre Supply Co.
OKLAHOMA CITY—Nat'l Theatre Supply Co.; Oklahoma Theatre Supply Co.
PHILADELPHIA—Blumberg Brothers; Nat'l Theatre Supply Co.
PITTSBURGH—Atlas Theatre Supply; Nat'l Theatre Supply Co.
SALT LAKE CITY—Inter-Mountain Theatre Supply Co.
SAN FRANCISCO—C. J. Holzmueller; Nat'l Theatre Supply Co.; W. G. Preddey Theatre Supplies
SEATTLE—B. F. Shearer Co.; Nat'l Theatre Supply Co.
SIOUX FALLS—American Theatre Supply Co.
ST. LOUIS—City Electric Co.; Nat'l Theatre Supply Co.
TOLEDO—Theatre Equipment Co.
WESTERLY, R. I.—G. M. Payne Motion Picture Service
CANADA—
Dominion Sound Equipment, Ltd. Montreal, Quebec
General Theatre Supply Co. Montreal, Quebec
Perkins Electric Co., Ltd. Montreal, Quebec
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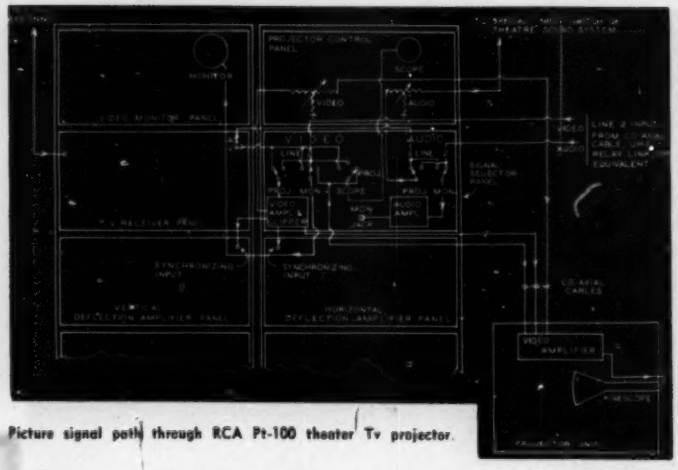


Picture signal path through RCA Pt-100 theater Tv projector.

picture when the projector button is depressed. This condition will, of course, be found to exist if the video gain control is set at zero.

Oscilloscope Input Check

An additional check on the video signal is always desirable and sometimes required. The incoming video signal must have a minimum value of one volt, peak-to-peak, in order to provide sufficient picture brightness. A 3-inch diameter standard oscilloscope tube, and associated circuits, is mounted in the projector control panel. The input to this oscilloscope may be obtained from input line No. 1, input line No. 2, or from the output of the video amplifier in the projector barrel, by means of another set of three interlocking pushbutton switches. However this 3-inch oscilloscope shows the waveform of the video signal, instead of converting it into a picture as the video monitor does. The height of this waveform pattern is proportional to the peak-to-peak value of the input voltage.

By turning the oscilloscope input control knob from "operate" to "calibrate," a one-volt peak-to-peak standard signal produces two horizontal lines on the face of the scope. The vertical distance between these lines will be the same as the vertical height of the video signal when its value is the required one volt peak-to-peak. Thus, either of the two incoming video signals, or the output of the video amplifier, may be quickly checked for proper voltage.

A built-in voltage reducer, or attenuator, reduces the high output voltage of the video amplifier to one volt before applying it to the oscilloscope or the monitor.

Part of the video signal is tapped off ahead of the video gain control. This part is amplified, "clipped," and its blanking pulses used to control the black-level voltage at the projector. Its sync pulses are used to control the picture synchronization, and are applied to the vertical and horizontal deflection amplifiers. Here they serve to keep the vertical and horizontal beam deflection voltages in step with the corresponding voltages at the transmitter.

[The next installment of this series of six articles will deal with the manner in which the picture is formed and projected from the Kinescope to the screen.]

Kodak Liberalizes Pension Plan

Changes liberalizing certain parts of the Eastman Kodak Co.'s pension plan have been announced. They include:

1—Increased minimum payments.

2—A provision enabling women to earn greater pension credits.

3—Elimination of the former length of service requirement for pensions at age 65.

4—Supplemental payments under some conditions.

NEW MINIMUM PAYMENT: At least $75 a month, plus social security, for those with 30 or more years' service if retired on or after Jan. 1, 1950. Those with less than 30 years will get an amount equal to $2.50 per month for each year of service, plus social security.

Omit Service Requirement

SERVICE REQUIREMENT: For employees who reach 65 there will be no length of service requirement, regardless of how brief their time with the company. Thus every person hired before 65 may retire on the pension he or she has *earned* at 65. Previously, requirements were 20 years for men, 15 years for women.

SUPPLEMENTAL PAYMENTS: Under certain conditions Kodak will make extra payments to Kodak people already retired or who will retire in the future. In general these will be made when the rise in social security amounts to less than 25% of the company pension, and in certain disability and early retirement cases.

Standard 16-mm Travel-Ghost Test Film

Promulgated by American Standards Association

1. Scope and Purpose

1.1 This standard describes a method of determining freedom from travel-ghost in 16-mm sound motion picture projectors.

2. Definition

2.1 Travel-ghost is a blurring effect seen on the screen and evidenced by vertical tails or light streaks added to the projected images of the transparent areas on the test film. It is caused by the projector shutter being out of synchronism with the intermittent mechanism, either by faulty adjustment or faulty design.

3. Test Film

3.1 The test film used for determining freedom from travel-ghost shall carry a pattern of small transparent areas upon a dark background. There shall be at least six transparent areas, three of which shall be located not farther than 1/32 inch from the top of the frame, and three not farther than 1/32 inch from the bottom of the frame. Four of the areas shall have their edges 1/32 inch from a side edge and either the top or bottom edge of the frame. The density of the transparent areas shall be less than 0.2, and the density of the dark background shall be greater than 2.2.

3.1.1 *Standard Length of Film.* The standard length of test film shall be 100 feet.

3.1.2 *Leader and Trailer.* Each test film shall have a suitable leader, title, and trailer.

4. Test Method

4.1 A test film in accordance with 2.1 shall be projected at standard sound speed of 24 frames per second (±2%) upon a white matte screen, the projected image of the projector picture aperture being of such size that a screen brightness of 10-foot lamberts is obtained with the projector shutter running, but with no film in the gate. The screen image of the test film shall be viewed from a distance equal to twice its width, and the presence or absence of travel-ghost noted.

[NOTE: A test film in accordance with this standard is available from the Society of Motion Picture & Television Engineers.]

Typical travel-ghost pattern for 16-mm film, magnified about 8 diameters.

Carbon Arcs vs. Inkies for Non-Theatrical Projection

By HARRY H. STRONG
Strong Electric Corporation

The intense brightness of carbon arclamps can greatly extend the use of 16-mm films. Larger audiences can attend showings, since a much bigger and clearer picture may be projected than can be obtained with incandescent lamps.

UNDER what conditions should arclamps, rather than incandescent filament lamps, be employed in motion picture projection? This question is in the minds of many of those in charge of films in the school and in the business worlds. Since there are so many borderline cases and unusual combinations of influencing factors, manufacturers have been reluctant to set down a formula for making final decisions.

However, the use of carbon arclamps has so enlarged the scope of usefulness of 16-mm picture projection, and the many advantages of this brighter light source have been so stressed, that a set of guides is definitely needed.

Just where should 16-mm projection and 35-mm projection be employed?

Any Conflict Unnecessary

First, there should be no conflict nor competitive situation between these two film gauges. In fact, the trend is to limit the use of 35-mm prints wherever possible. Many motion picture people deny this, however, maintaining that the narrower film does not offer enough detail for the larger size screens.

The big advantage of 35-mm film is that timely subjects (newsreels, documentary films, *etc.*, are available to non-theatrical accounts much sooner than they can be had on 16-mm. In addition, schools may rent 35-mm entertainment pictures for projection in auditoriums at recess periods. This has been with the consent of theatermen in some locations, who feel that the exhibition does not really constitute competition to their established business or perhaps are afraid that refusal to waive such protection would result in bad public relations.

In any event, the school which elects to use inflammable 35-mm film must do so only in an auditorium where a fireproof projection room is provided, never in a classroom. However, 16-mm film is non-inflammable and may be projected anywhere without restrictions.

For this and other reasons, interest has been mounting in the use of arclamps for 16-mm projection. Arclamps designed for 16-mm projectors are usually a smaller counterpart of the lamps employed in theaters. The arc lamps measure, in inches, about 23 by 13 by 13. They project five times the light of incandescent filament lamp equipment at less than one-half the operating cost!

Relative screen sizes that can be illuminated to the same brightness.

When 1500 lumens of light are projected, brilliant pictures are possible in large-size screens and greater audiences can witness each showing. In fact, six times as many persons can attend if the room be large enough. Furthermore, the use of larger and brighter images on the screen "blows up" subject matter in pictures which would otherwise be indistinguishable on a smaller screen.

The switch from incandescent filament lamp projection to arclamps has been rapidly accelerating. Some schools already have classrooms and auditoriums which can accommodate this improved projection; while others are making provisions for the changeover. Manufacturers are urging those who are planning new schools to have the architects include small projection rooms connected to each of the larger classrooms.

Typical division of room space.

Determining Factors

The factors which determine whether incandescent filament lamp projection or arclamps should be used are: size of the room and the audience, ambient light, portability of equipment, simplicity of operation, and operating costs.

The illusion of reality in a picture presentation is best achieved when the screen is just large enough to be included in the normal viewing angle of the eye. A larger picture necessitates undue visual fatigue in following the action of the picture across the screen; while a smaller picture introduces the impression of remoteness. The result of the practical application of these principles is a picture having a width equal to one-sixth the distance from the screen to the back row of seats. For example, in calculating the correct screen size in a room 35 x 40 feet, where the rear row of seats is 36 feet from the screen, the picture should be 6 feet wide.

Because of aisles and areas where oblique viewing causes distortion of the screen image, the usable seating area of the room seldom exceeds two-thirds of the total floor area.

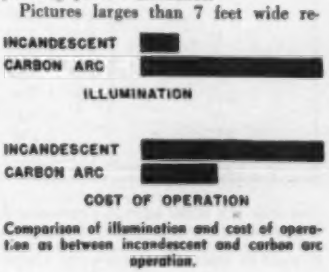
A 35 x 40 foot room with a floor area of 1400 square feet offers no more than 1000 square feet of usable seating space. Since about 10 square feet is required per person, this room will not seat more than 100 people for a screen showing.

Comporative Brilliancies

The attainment of satisfactory results with 16-mm equipment requires a light source of sufficient power to afford a screen brilliancy comparable with that of commercial theaters. (Brilliancy is in direct proportion to the volume of light projected, and inversely proportionate to the area of the projected picture.)

An incandescent filament lamp projecting 300 lumens of light results in 10-foot-candles over the 30 square foot area of a screen 6½ feet wide, which just meets the accepted standard for pleasing picture brilliance.

Pictures larges than 7 feet wide re-



Comparison of illumination and cost of operation as between incandescent and carbon arc operation.

TABLE I

Viewing Distance from Rear Seat	Screen Width	Room Size	Total Area	Audience Size
24	4	23 by 28	650	40
36	6	35 by 40	1,400	95
42	7	40 by 45	1,800	120
54	9	50 by 60	3,000	200
72	12	70 by 80	5,600	375
90	15	85 by 100	8,500	575
108	18	100 by 120	12,000	800

This table has been calculated on ideal conditions, that is, where the room is as dark as a movie theater. Where it is impossible to exclude extraneous light, as in many school auditoriums, the picture is less brilliant and more light is required.

quire a brighter light source than is obtainable with the incandescent filament lamp without sacrificing clarity. Accordingly, the use of an arclamp is required. The carbon arc projects 1500 lumens, or five times the 300 lumens projected by an incandescent filament lamp, and accordingly delivers 10 foot-candles of light over an area of 150 square feet, which is the area of a screen five times as large, or 15 feet in width. A screen of this size is large enough for an audience of 575.

The snow-white quality of the light projected by the high-intensity carbon arc gives a sparkling brilliance to the picture and imparts the illusion of even higher intensity, permitting a satisfactory projection of pictures as wide as 18 feet. A screen of this size is large enough for an audience of 800 people.

Other Important Aspects

From the foregoing formula and the available floor area, the seating capacity, screen size, and necessary light source may be calculated. Table I will aid in determining the requirements under various conditions. Where it is impossible to exclude extraneous light to attain an ideal darkness, as in many school auditoriums, the apparent brilliancy of the picture is reduced and more light must be projected. In many cases, it is necessary to use arclamps for projecting pictures even smaller than 6 feet in width.

In every installation the projection distance depends on where the equipment can be located, and to attain the required picture size, a lens of the correct focal length must be used. If there is a choice of location, the projector should be placed at a distance from the screen that permits the use of a 2-inch focal length lens, because this standard size lens, which passes the maximum amount of light is a lower priced production item and is readily obtainable.

Although not as readily portable as the incandescent filament lamp projector for frequent moving from room to room, the carbon arc projector may be easily moved to out-of-the-way locations when not in use.

Carbon Arc Not Complicated

The carbon arc, as compared with the incandescent filament lamp, seems vastly more complicated to the casual observer. The truth is that the operation of the carbon arc is no more complicated than threading a projection machine. The expendable carbons are replaced easily and quickly.

Operating costs of the carbon arc are less than one-half that of incandescent lamp equipment, based on a cost of $6 for an incandescent bulb having 10 hours life, or 60 cents and hour, as compared with a cost of 24 cents for a pair of carbons which burn one hour. This represents a saving of 10 hours of service weekly, or approximately $200 a year.

Canadian Film Equipment Data

U. S. equipment has long predominated in Canadian theaters. While there has been no significant change during the past year, there has been a continuation of the trend toward manufacturing in Canada (often by U.S. subsidiaries) of a greater portion of the less specialized machinery; and, where equipment is partially manufactured in Canada, the tendency is steadily to give it more Canadian content.

The only foreign competitor of the U. S. in this field is the United Kingdom. British products are currently getting a slightly larger share of the Canadian market than formerly, owing to the price advantage they enjoy as well as the price-depressing effect of the devaluation of the pound in September, 1949.

Aggressive British Selling

Of course, the 117 theaters owned and operated by a British theater chain are almost entirely equipped with British projection and sound machinery. Canadian independent theater owners seemingly find the British equipment satisfactory, although the majority prefer the U. S. product.

Distributors of British equipment are intense and aggressive in their efforts to expand sales in this market!

The British share of the Canadian market is approximately 15%, and its outlook for expansion is favorable.

Equipment dealers had a good year in 1950. In fact, every year since the end of the war has been good. Responsible in a large measure for the favorable market for motion picture equipment during the past several years, has been the unprecedented theater building boom. From 1939 to 1946, construction of motion picture houses was rigidly restricted by wartime controls. Upon the termination of hostilities, however, restrictions on construction of places of amusement were among the first to be lifted, and theaters have been opened at a record rate since. From the beginning of 1946 to October 20, 1950, a total of 471 new theaters have been opened in Canada, 131 were under construction, and 126 were planned.

TABLE II

16mm Projector Lens Focal Length (distance from film to center of lens)	Distance in Feet from Screen												
	8′	10′	12′	20′	25′	32′	36′	40′	50′	75′	100′	125′	150′
	Width of Picture												
¾″	4′0″	5′0″	6′0″	10′0″	12′6″	.....	.....	.....	.....	.....	.....	.....	.....
1″	3′0″	3′9″	4′6″	7′6″	9′4″	11′11″	13′5″	14′11″	.....	.....	.....	.....	.....
1½″	2′0″	2′6″	3′0″	5′0″	6′3″	8′0″	9′0″	10′0″	12′6″	.....	.....	.....	.....
2″	1′6″	1′10″	2′3″	3′9″	4′8″	6′0″	6′9″	7′5″	9′4″	14′0″	18′9″	23′5″	28′1″
2½″	1′2″	1′6″	1′9″	3′0″	3′9″	4′9″	5′4″	6′0″	7′6″	11′3″	15′0″	19′8″	22′5″
3″	...	1′3″	1′6″	2′6″	3′1″	4′0″	4′6″	5′0″	6′3″	9′4″	12′6″	15′7″	18′8″
3½″	...	1′0″	1′3″	2′1″	2′8″	3′5″	3′10″	4′3″	5′4″	8′0″	10′8″	13′4″	16′0″
4″	...	...	1′1″	1′10″	2′4″	3′0″	3′3″	3′9″	4′8″	7′0″	9′4″	11′8″	14′0″

This table is a handy guide in determining the type of lens required to project pictures of different sizes at various distances. For example, in a room where the projector is set 10 feet from the screen, it would be impossible to obtain any picture by using a lens having a focal length of 4 inches. However, in an auditorium where the distance from the projector to the screen is 150 feet and the screen width is 14 feet, the same lens would be ideal. Other factors, of course, contribute importantly to over-all optimum results.

This 'Mysterious' Aerial Image

By ROBERT A. MITCHELL

THE theory of projection optics, simple at first thought, complex in fact, has been made bewildering by misconceptions entertained even in high projector-manufacturing circles. It seems incredible that any manufacturer should be guilty of crass ignorance concerning a technical subject which has been reposing on his own doorstep for quite a number of years.

A sound knowledge of projection equipment is built upon an acquaintance with the mechanical, optical, and electrical fundamentals involved in the functioning of that equipment. Now that the art of projection has passed the half-century mark, it would seem that the optical theory of projection would be an old, old story to everyone. Recent contributions touching upon this subject, however, lead us to believe that such is not the case.

As Larry Davee* points out (IP for October, 1950, p. 12) a motion picture lens, even though complicated by several glass elements inserted for the purpose of correcting chromatic and spherical aberration, works exactly the same as a simple lens. Because this is true, we can employ single-element lenses in diagrams intended to illustrate the principle of projectors and cameras.

Pickup From Every Point

Figure 1 illustrates optical projection under the most simple conditions. The "object" (film-photograph or lantern slide) is evenly illuminated by light from an ordinary bulb. A ground-glass plate is interposed between the bulb and the transparent picture in order to insure *perfect diffusion* of the light.

It will be readily appreciated that light from every point of the picture is picked up by the entire surface of the projection lens and thrown onto the screen to form an enlarged image. It may be seen also that the lens inverts the image, hence the picture must be placed upside-down in the projejctor in order to show right-side up on the screen.

The paths of the light rays which determine the boundaries of the beam emerging from the lens are indicated by straight lines. The beam, therefore, has its smallest diameter close to the lens.

Figure 1, however, *does not represent the optical conditions peculiar to the standard motion picture machine!*

Factual Optical Conditions

In motion picture projection, the illumination is furnished by a mirror or condenser of limited size placed at a considerable distance behind the projector aperture. Although we seldom give it a thought, the mirror, itself, is an "object" which is "imaged" by the projection lens. Because the distance between mirror and projection lens is greater than the focal length of the lens, the image of the mirror must be a reduced image. And it must lie somewhere between the lens and the theatre screen.

The projector, therefore, forms two optical images at the same time: an enlarged image of the film on the distant screen, and a reduced image of the mirror only a few inches in front of the lens.

In forming an image of the mirror, the projector acts just like a snapshot camera pointed at the moon. The camera lens brings all the rays it receives from the moon to a focus on a film or plate. And because the distance of the moon from the camera lens is much greater than the focal length of the lens, the image of the moon is vastly smaller than the actual size of the moon.

All this is very obvious, indeed; but it must especially be emphasized that the camera lens (if it be a good one) does not scatter and lose any of the moon's rays, but collects all of them into an image of the moon. No moonlight will fall anywhere on the plate except within the boundaries of the little moon image.

Orienting the Aerial Image

So it is with the movie projector. All of the light which reaches the lens from the mirror must be collected into the little mirror image which hangs unseen in space from 2 to 4 inches in front of the lens barrel. To see this "aerial image" of the mirror one need only hold a piece of cardboard—preferably dark—in the plane where the aerial image is formed. The hole in the mirror and the positive carbon support will be clearly visible, though the image is upside-down.

The cardboard is then strictly analogous to the plate of the camera photographing the moon. Fig. 2 shows what the light-beam would look like if all of the projector except the arc mirror, carbons, and projection lens could be made invisible. The optical diagram immediately below this picture indicates how the rays form the aerial image in front of the lens.

Is it not as plain as day that no light reaches the theatre screen from the projector except that which has passed through the aerial image?

Figure 1 cannot represent the actual paths of the light-rays because no aerial image is formed under the conditions of perfectly diffused illumination. We cannot merely substitute an arc mirror for the bulb and frosted glass, as in Fig. 3, and get a true diagram.

In fact, Fig. 3 is completely false, as may be gathered from the various question-marks which indicate our skeptical state of mind. From what source of illumination, we ask, do the rays indicated by the heavy dotted lines come? Certainly not from the arc-lamp mirror, because the mirror sub-

(Continued on page 28)

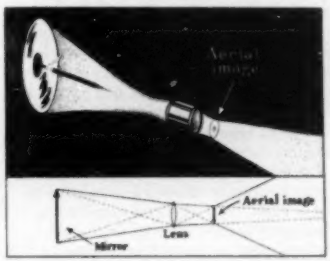


FIG. 2. The formation of a reduced image of the mirror—an "aerial image"—in front of the lens of a motion picture projector.

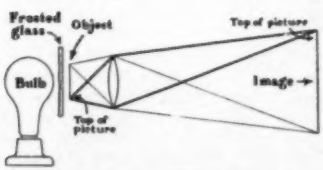
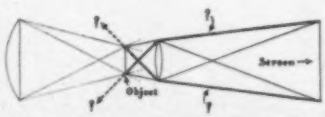


FIG. 1. Optical projection under the simplest conditions. Because the illumination is diffused by the frosted glass, no secondary image is formed between the lens and the screen. Inexpensive photographic enlargers have this type of optical system.



An "Optical Booby-Trap"

FIG. 3. You won't win a prize by finding the errors in this diagram, but you'll find out how even experts have been tripped up by projection optics. See text for the solution of this puzzle.

* Century Projector Corp.

IN THE SPOTLIGHT

By *HARRY SHERMAN*

THIS department accords top priority for this issue to a topic which has been the subject of considerable private and union-meeting discussion among IA members during the past several years—the institution of some form of welfare plan for the organized workers in the amusement crafts.

Oddly enough, while the stage employes, whose members generally are older men, were most vocal in pressing for welfare plans, it remained for a projectionist unit—Local 110 of Chicago—to put the lid on the stove, so to speak, and conclude the first hard-and-fast complete welfare coverage for its members.

Much valuable data on employe welfare plans is contained in a brochure issued recently by Bankers Trust Co., of New York, which is already administering pension plans for nearly 200 leading commercial and industrial organizations. This report indicates, we think, certain definite trends in welfare plans which are worthy of summarization here.

The report contains two sections: one dealing with what are termed "unilateral" plans which are instituted and administered by the employer, and the "negotiated" plan which is a matter for agreement between the employer and the union and is usually administered jointly. Of late, unions have shown a strong preference for the negotiated plan, particularly with respect to its administrative feature.

Quite apparent in both plans within the past two years has been the trend toward a liberalization of eligibility requirements as to age level and years of service. A great majority of the plans, whether new or already in effect, have been liberalized by an average of five years on both these counts. While 65 years of age continues to be the retirement level for a great majority of plans now in effect, there is every indication that amendments lowering this figure by five years will be effected. Service requirements average out at about 25 years, although many plans provide for a lesser payment pro rata upon earlier retirement.

In the negotiated plans the pattern has been such as to establish standard retirement benefits. The $100-a-month benefit, *including* Social Security payments, has become practically standard in negotiated plans in which the *employer* pays the *entire* cost. This assumes that the employe retires with 25 or 30 years of service and was paid at a rate not in excess of $3500 per year.

Most plans deduct, in addition to Social Security benefits, payments received by the employe from "other sources," such as other pension plans to which the company may have contributed, dismissal and unemployment payments, and similar benefits to which he may be entitled.

The steel, rubber and aluminum plans have no *compulsory* retirement provision and allow an employe to work as long as he is physically able. The other patterns provide an automatic or compulsory retirement age, but two permit the employer to retire workers (except for inability to work efficiently) as early as age 65. In several of the plans having this compulsory or automatic feature, the employes who were over or close to that age on the effective date are not being *forced* to retire immediately but are being permitted to continue work for periods of up to five years.

All of the plans include a provision for disability benefits, most of which are limited to *total* and *permanent* disability, and no benefit is provided for disability of a temporary or partial character. Benefits in most of the plans do not start until total and permanent disability has been established over a six-month period.

Of course, practically all the data contained in the Bankers Trust Co. report applies to industries which are of a totally different character from that of the amusement field. While there are many instances where an amusement worker may stay on one job for one employer for a long span of years, there are countless other instances where the worker may have anywhere from five to ten different employers over a period of years. This is particularly true of studio workers and of stage employes, with a given job lasting only for the duration of production or for the run of the show. Projectionists are on a somewhat more stable basis.

On this basis, it would seem that benefit plans for IA workers could hardly ever be satisfactorily negotiated on a national scale, and certainly not on the basis of including all the various crafts with widely fluctuating terms of employment. Of course, there is the possibility of writing into every IA contract, irrespective of for what craft, a provision for payment of a certain percentage of total wages into a general welfare fund. Such a plan would necessitate exclusive con-

NOTABLES PRESENT AT THE INSTALLATION OF 25-30 CLUB OFFICERS FOR 1951

Left to right: Walter Green, president, National Theater Supply Co.; Harry Sherman of IP; Admiral R. B. Tompkins, president, International Projector Corp; Allen G. Smith, N.T.S. New York branch manager; B. Passman, chief engineer for I.P.C., and Arthur Meyer, vice-president and general sales manager of I.P.C.

trol of the funds thus accumulated by the union, probably the General Office—which would pose a terrific administrative problem.

Craft, Area Likely Basis

Overall, it seems practically certain that any benefit plan for IA workers would have to be negotiated on the basis of craft and local area, much after the pattern of the Chicago Local 110 set-up. Moreover, it seems equally certain that administration of such benefit funds would have to be vested solely in the union, in view of the character of the work performed by its members.

The foregoing data is offered solely to stimulate thinking on the part of IA craftsmen and in the hope that it may help to "jell" the craft's thinking anent this extremely important topic.

• The prolonged strike of San Antonio Locals 76 and 407 against the Zaragoza Amusement Co. came to an end last month with the signing of contracts between the circuit and Local Union officials. Intensive picketing and court actions marked the 21-month deadlock between these groups, and the final settlement of this dispute is a signal victory for the union. The Alameda Theatre is the first in the Zaragoza chain to employ union projectionists—three men, each man to receive $85 per week, two weeks on and one week off, with a $5 per week increase to become effective in six months.

Ernest (Frenchy) Biencourt, Roy Cogdill, business representatives for Locals 76 and 407, respectively, and Henry Van Archer, attorney, represented the union in the negotiations.

• Tom Canavan, brother of former IA President Bill Canavan, was once more elected a delegate to the Variety Club national convention, representing St. Louis Variety Tent No. 4.

• History has a way of repeating itself. Five sons of Bill Thompson, popular business representative for Pittsburgh Local 171, served with our armed forces during World War II. Recently, his youngest son, Richard, was inducted into service, and another son, Robert, is stationed in Kentucky.

• IA President Richard Walsh emphatically denied a statement, attributed to him by a widely-read theatrical weekly, that projectionist Local Unions throughout the country are "for the most part satisfied with their present scales and are not likely to be coming up with new demands." At a recent press conference, President Walsh, in response to a query by a reporter for the weekly, said that no drive for projectionists' wage increases was being made by the General Office because *each Local has the right to negotiate its own contracts.*

Walsh said that his statement, as it appeared in the weekly, was misquoted, was untrue and harmful; that "if we ever reach the time when groups of employes, or employers, in America really do stop striving for a better income, then we may be sure that this country we have loved and believed in has started to decline." The IA leader asked that the trade press generally publish an accurate statement of his views.

• As an aftermath to the trial and conviction last year of the 11 top national Communist leaders, Harry Sacher, one of the defense attorneys, was ousted as attorney for New York Local 306, a post he has held for the past several years. The retention of Sacher as counsel for Local 306 had long been the subject of hot debates in and out of the meeting rooms, and a vote taken at the January 3rd meeting culminated in his ouster. Sacher was attorney for a number of unions in and around New York City, and his dismissal from Local 306 is one of several in the past few months.

• An amicable settlement reached between IA Representative Eddie Miller, who is also business representative of Houston Local 279, and Julius Gordon, president of East Texas Theatres, Inc., ended the 120-day-old strike of projectionists in the Baytown area. Picket lines were withdrawn and the projectionists returned to work.

• Congratulations to our very good friends, Nettie and Hector Stewart, Buffalo Local 233, who celebrate their 22nd wedding anniversary on Hector's 56th birthday, January 25. Hector's membership in the Local dates back many years, and we know that the double celebration will be a very joyous one for the Stewarts.

• The TMA (Theatrical Mutual Associations) will hold its 32nd biennial convention at the Neil House, Columbus, Ohio, July 9-11 next. The installation of officers and a dinner party will be held on Wednesday, July 11.

• The IA Executive Board will hold its mid-winter session at the Santa Rita Hotel, Tucson, Arizona, the week beginning February 5.

• Completing 30 years of service, Jack Hauser resigned from the office of business representative for Local 96, Worcester, Mass. However, he is still working at the Poli Theater, where he has been employed for many years.

• The AF of L lost a grand old man when Joseph N. Weber, 84, president emeritus of the American Federation of Musicians, died last month at his home in Beverly Hills, Calif. Joe Weber held the office of president of the musicians' international union for 40 years, until his retirement in 1940. His union worked in close cooperation with the IA back in the days of Charlie Shay and Bill Canavan, and many a time Weber pulled his men out of theaters and kept them out until IA contracts were signed. Our organization cooperated in the same manner.

Joe Weber celebrated his 59th wedding anniversary September 1950, and at the AF of L 69th convention in Houston last September he was called to the convention platform where he was congratulated by President Green and was given an ovation by the delegates.

Ten-Year Film Theater Data

Motion picture theaters in the U. S. reported receipts, including taxes, of $1,569 million for 1948, a gain of 133% over the 1939 figure of $673 million, reports the U. S. Dept. of Commerce. Data for drive-in and portable motion picture theaters are not included in these figures. The total number of film theaters increased from 15,115 in 1939 to 17,689 in 1948, an increase of 17%. Individual theaters doubled their dollar volume of receipts, the average establishment taking in $88,693 in 1948, compared with $44,528 in 1939.

Employment in motion picture theaters increased from 128,857 to 181,322 for the workweek ended nearest November 15 in both Census years. For the country as a whole, annual payroll in theaters rose from $132 million in 1939 to $295 million in 1948. Employees shared in the industry's growth with their average annual wage (full and part-workweek combined) increasing from $1,021 to $1,625 during the period 1939 to 1948.

Dollar Volume Soars

Increases in dollar volume of receipts were general throughout the country and a larger number of theaters was recorded by most States. The largest increases in receipts were reported by Florida (251%), Alabama (208%), and Arkansas (205%). Mississippi, Arkansas, and Alabama led the Nation in gains in the number of theaters for 1948 over 1939, reporting increases of 69%, 68%, and 58%, respectively.

New York, California, Pennsylvania, and Illinois, each reporting motion picture theaters receipts in excess of $100 million in 1948, accounted for 25% of the number of establishments, 39% of the dollar volume, and 42% of the payroll of the entire country for this industry. Comparable figures for these same States in 1939 were 26%, 41%, and 42%.

Westrex Corp. Personnel Busy

Reeve O. Strock, recording manager of Westrex Corp., subsidiary of Western Electric Co., has returned to the New York office after a world-wide trip concerned with sales, engineering and general contact work. Latest Westrex installation is a new sound recording unit at Bell Productions & Television Films, in Miami, Fla.

Brush-up on Fundamentals

II. CAPACITANCE. Another in the series of articles designed to serve as a refresher course in certain technological fundamentals and their application to new equipments and processes which may be utilized in the motion picture theater field in the near future.

CAPACITANCE, which is manufactured commercially and is known as a condenser, is equally important in radio as is inductance. Not all capacitance, however, is found in the form of commercial units; sometimes it exists between certain radio components. More often than not such capacitance results in poor performance in a radio receiver and steps are taken to eliminate or reduce it. Capacitance of this kind is known as "stray capacitance."

Whenever two conductors of electricity are separated by an insulator, a condenser is created. The insulator in a condenser is often called a "dielectric." The dielectric may be a vacuum, air, glass, mica, waxed paper, oil, ceramics, or a chemical deposit such as aluminum oxide. The conductor is usually constructed of steel, aluminum, tinfoil, brass, or metallic paint.

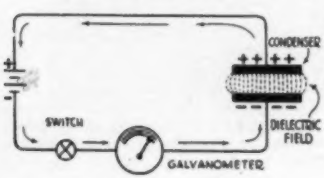
Condenser types usually are designated with respect to the kind of dielectric that they contain. For example, a paper condenser contains a paper dielectric, and a mica condenser contains a sheet of mica as the dielectric.

Action of a Condenser

The action of a condenser will now be considered. Let us suppose that a condenser is connected, as shown in Fig. 1. This is a series circuit consisting of a condenser, a battery, a zero center scale galvanometer which reads to the right or left, depending upon the direction of current through the meter (similar to an ammeter in an automobile), and a switch.

When the switch is open the condenser does not have any charge on it; and when the condenser is not charged it is said to be in a neutral state. At the instant that the switch is closed, electrons rush from the upper plate of the condenser into the positive terminal of the battery. It should be remembered that a battery is a source of electrical pressure and is capable of forcing free electrons to move. The positive terminal of the battery is deficient in electrons. When it is connected to the condenser it will draw some free electrons from the plate of the condenser to which it is connected.

FIG. 1. Charging a condenser.



The negative terminal of the battery has an excess of electrons. These excess electrons will now move into the lower plate of the condenser because this plate is connected to the negative terminal of the battery. The direction of electron flow is indicated by the arrows in Fig. 1, and because electrons flow through the galvanometer it will give an indication.

The atoms which make up the condenser have been disturbed from their neutral condition due to the transfer of electrons from one of the plates to the other. This disturbance will create lines of electrostatic force between the plates of the condenser, and these lines of force result in a dielectric field between the plates.

Storage Characteristics

All condensers are capable of storing a certain amount of electrical energy (dielectric field) depending upon their capacity (size). When the condenser in Fig. 1 has stored all the energy of which it is capable, the electrons in the circuit will cease to flow. The condenser is then charged to the same voltage as the battery, and the circuit is similar to one which contains two batteries of equal voltage in parallel. In practice, it takes only a fraction of a second to charge a condenser to the voltage of the charging source.

Because the flow of electrons is only in evidence for a very short period of time, the galvanometer will act in the following manner. At the instant the switch is closed the needle of the meter will kick to the right and then return to zero. This indicates that the current in the circuit flows for only a very short period. If the battery were now removed from the circuit the dielectric field would still remain.

Effect of Closed Switch

Theoretically, the field should remain indefinitely if the condenser is not disturbed. In practice, however, the field deteriorates rapidly when the battery is disconnected, because the electrons which have left the upper plate of the condenser desire to return to it and will do so by leakage through the dielectric or through the air.

Figure 2 is very much like Fig. 1, except that now the battery has been removed from the circuit. When the switch is open the dielectric field still exists between the plates of the condenser. Let us suppose that the switch in Fig. 2 is closed. The electrons from the lower plate of the condenser will now return to the upper plate from which they came originally. The direction of current in the circuit has now reversed from that in Fig. 1, and the meter will kick to the left and then return to zero when all of the electrons have returned to the upper plate.

The condenser is now said to be discharged and the dielectric field will disappear completely. Although the electrons have moved in the circuit, none have actually passed through the condenser, because the plates of the condenser are separated by an insulator and the electrons cannot move through an insulator.

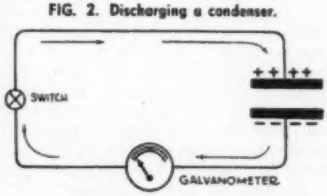
When D.C. is impressed upon a condenser, current flows in the circuit for only a fraction of a second and then becomes zero. Because current flows for only a fraction of a second, it is said that D.C. does not allow current to flow in any circuit which contains a condenser. As we shall see a little later, A.C. will allow current to flow in a circuit that contains a condenser.

Filter Condensers

A condenser is very useful in radio circuits for separating direct currents from alternating currents. A condenser has a smoothing effect when placed across a direct current that is varying slightly in amplitude (pulsating D.C.) and these condensers are commonly used in the power supply section of radio receivers. In this application, they are known as "filter condensers."

When an exciter lamp in a motion picture projector is operated from rectified A.C., a great deal of filtering is necessary in order to remove the 60-cycle hum which would show up in the sound. Large con-

FIG. 2. Discharging a condenser.



densers are used for this purpose. Whenever circuits which contain a large amount of inductance are opened, a great deal of sparking results at the switch contacts. This is true of D.C. circuits which feed motors, generators, spark coils, relays, and automobile ignition systems.

Since inductance tends to keep the current flowing when the switch is opened, a hot spot develops on the switch contacts. This hot spot burns the contacts and carries away from them small particles of copper. This action results in premature wear on the switch and lowers its efficiency as a switch because of pitted contacts. If a condenser is placed across the switch contacts, the condition is soon remedied. The reason for this is that the energy set flowing by the inductance in the circuit charges the condenser and eliminates sparking.

Condenser Size Factors

The amount of energy that the dielectric field of a condenser can store depends upon the size of the condenser—the larger the condenser, the greater the energy. The size of a condenser depends upon four factors:

(1) The area of the plates facing each other.

(2) The number of plates that are connected in parallel.

(3) The distance between the plates or the thickness of the dielectric, and

(4) The type of dielectric used.

If the quantities in the first and second factors listed are increased, the capacitance of the condenser will increase, as will its ability to store energy. If the distance between the plates were increased, the capacitance would decrease because the concentration of the dielectric field would be less dense.

The type of dielectric used in a condenser is very important in determining its size. The atomic structure of some dielectrics is such that they aid the dielectric field more than others when an electrical pressure acts upon them. This quality has been designated as the "dielectric constant."

The didelectric constant of air is 1, and the dielectric constants of other materials differ widely. Mica, for example, has a dielectric constant of approximately 6. Let us see what significance this has. It means that if an air condenser has a certain capacitance and if mica were substituted for air, the capacitance of the condenser would increase six times.

Dielectric Strength

The dielectric strength of an insulating material is the minimum value of electric field intensity required to rupture it. Dielectric strength usually is expressed in kilovolts per centimeter of dielectric thickness. Heating of the dielectric leads to rapid deterioration, particularly if moisture is present, and ultimate breakdown. Most dielectrics will withstand a much higher voltage for a very brief period than voltage applied for a longer period.

These effects have dictated two tests for condensers: a high flash-test voltage of very brief duration, and the application of a much lower voltage for a longer period.

If too large a voltage is impressed upon a condenser, its dielectric may be pierced by a spark which jumps through it. In condensers using paper, mica, or glass as the dielectric, the puncture of the dielectric by too great a voltage will prove fatal and will render the condenser useless for radio work. A condenser using oil, a wet electrolyte (borax solution), or air, will heal itself after the excessive voltage is removed. This excessive voltage is known as the "breakdown voltage."

Condensers should never be operated with such a high voltage across them. The safe voltage which may be impressed across a condenser is called the "working voltage." Lower voltages may be used, but voltages higher than the working voltage should never be used for more than a brief period.

A condenser can be made to withstand very high voltages by increasing the thickness of the dielectric, but this is not always feasible because the capacitance of the condenser decreases as the thickness of the dielectric increases. In order

(*Continued on page 26*)

The Ashcraft Hydro-Arc Lamp

COVERING a wide range of operating current, the new Ashcraft Hydro-Arc lamp has proved its flexibility under actual field conditions, whether used in the larger enclosed theaters or for the medium-sized drive-ins. The lamp was designed when it became apparent that many exhibitors were attempting "conversion" of existing lamps, with badly mismatched optical systems, in an effort to obtain increased light output.

The Hydro-Arc permits the easy exchange of reflectors and carbon jaws, depending upon the light output desired: a 15-inch reflector is standard equipment with the 9-mm carbon, while a 14-inch mirror is used with the 8-mm carbon. A large lamphouse helps overcome the problem of excessive heat.

Wide Current Range Possible

When the 9-mm carbon is used, the Hydro-Arc utilizes water cooling for the carbon jaws. This unit is not used when 8-mm carbons are employed. Only three-fourths of a pint of water per minute flows through the cast bronze jacket surrounding the carbon to cool both the shoes and carbon. Rated capacity for the Hydro-Arc is 80-85 amperes with the 9-mm carbon, and 60-75 amperes with the 8-mm carbon.

Erratic positioning is avoided when manual reflector adjustments are made because of its mounting in a heavy cast aluminum ring which is swiveled to the back plate by means of a large ball and socket. The negative carriage is slide-mounted in a heavy cast aluminum housing which may be moved vertically or laterally on the compartment separation baffle by external controls for negative carbon tip positioning.

The entire arc control—feed motor, rheostat speed control, gearing and negative cam levers—is constructed as a unit and is placed vertically on the rear left-hand side of the lamphouse casting. All shafts operate on precision roller bearings to eliminate friction and wear. The motor is equipped with angular ball thrust bearings.

More detailed information anent the Hydro-Arc is available from C. S. Ashcraft Mfg. Co., 36-32 Thirty-Eighth St., Long Island City 1, New York.

Exterior view of Ashcraft Hydro-Arc as viewed from the rear and showing the outside positioning of the entire arc control assembly.

From the Production Front

New Technicolor Lighting System Tested by Top-Flight Cinematographers

Rigid tests of new color filming system have been completed in five major Hollywood studios, according to the appended report by *American Cinematographer*. Sharp gains in economy and photographic quality are seen, based on preliminary tests of this new system.

By LEIGH ALLEN

FOLLOWING the general announcement by Technicolor of its new low-light level photographic system, a demonstration of some of the tests photographed by five Hollywood studios with the new system was given recently before members of the American Society of Cinematographers. The test footage screened was photographed by director of photography Charles Rosher, at M-G-M studios; by Arthur Arling, at 20th Century-Fox studios; and by Charles Boyle, at Universal-International studio.

Initial photographic research on the system began at M-G-M under the direction of John Arnold. One of the largest single users of Technicolor, this studio considered it to their interest to explore the possibilities of materially reducing photographing costs when filming in color, a substantial item of which involves the lighting and set operation time required to place the great number of lighting units normally used. The "old" method of Technicolor photography demanded a working illumination of around 400 to 500 foot-candles.

The objective was to find a means for shooting Technicolor using, if possible no more light than is generally used for black-and-white pictures. To accomplish this would mean that the studios would be able to produce more pictures in Technicolor without materially adding to production costs. The main objective at the beginning, according to Arnold, was to develop a system that would enable studios to photograph Technicolor interiors entirely with low-level, unfiltered incandescent light instead of arc light.

This led first to a revision by Technicolor in the emulsion characteristics of the film used in the camera, a step which led naturally to the next—an important technical change in the optical system of Technicolor cameras. The final major step involved changes and improvements in the Technicolor film processing procedure. Thus, the whole new process involves and depends upon a chain of improvements, each dependent upon the other.

For the director of photography, the new Technicolor system involves no important change in procedure other than the use of incandescent instead of arc light, as at present. Most of those present during screening of the test films expressed the view that the new Technicolor system rendered a more pleasing overall tone, less harsh than the current system.

Adequate Light, Well Distributed

The tests photographed by Rosher consisted of three sequences of scenes staged and directed by George Sidney, and utilized three different sets. The first was a bedroom scene in which a girl enters, bids her escort goodbye at the door, then retires, turning out the room lights so that the only illumination is that filtering through the windows from out of doors. The keylight for this set was 100 foot-candles. With regular Technicolor it would have been 400 foot-candles.

When the room lights were extinguished, the keylight dropped to 30 foot-candles in the closeup of the girl. At all times the illumination is adequate, well distributed, and obviously carries to the depths required by the set.

The second set was a low-key church interior. The girl is kneeling before the altar and facing the camera. Camera alternates between closeup and medium shot. Keylight for this sequence was 75 foot-candles. A marked pictorial effect was that of the vari-colored light from the stained glass windows falling on the floor of the church behind the girl.

The third set was a full day exterior of a garden with the girl singing—first in closeup, then in medium and long shots as she alternated between dancing and sitting on the garden wall. Keylight for these shots was 100 foot-candles with cross lights of 125 foot-candles.

Color Temperature All-Important

According to Rosher, he began these tests on a purely experimental basis, proceeding on the basis that color temperature was all-important with the new system. "Color temperature must be correct in the light falling on faces," he

Projectionist Examination Questions

Based on Examinations by Leading U. S. Municipalities

1. Having a circuit 1000 feet long carrying 60 amperes with a voltage drop of 8%, the circular mil area is 33,100, the voltage is 110. What is the resistance of the circuit?

2. Having a 220-volt source, four Mazda lamps are connected across it with resistances of (*a*) 100 ohms (*b*) 200 ohms (*c*) 300 ohms, and (*d*) 400 ohms. What is the amperage of each lamp. Of each circuit? What amperage would they draw if they were one lamp?

3. If you had three resistances of 3.25 ohms, 4¾ ohms and 5 ohms, what is their combined resistance in series? In parallel?

4. If you had three condensers of 2 mfd, 6 mfd and 4 mfd, what would be the capacitive reactance if they were connected in parallel?

5. A 50 H.P., 440-volt motor has a full-load efficiency of 92% and a power factor of 0.8. How much current is required for single phase? Two phase? Three phase?

6. A 50 H.P. single-phase, 440-volt motor having a full-load efficiency of 92% and a power factor of 0.8 is to be operated at a distance of 1000 feet from the alternator, the wires are to be spaced 6 inches apart, the frequency is 60 cycles with a 5% loss. Determine the electrical H. P., the watts, the apparent load, size of wires, voltage drop, and voltage at the alternator.

7. Give the allowable current carrying capacity of at least five different sizes of wire with which you are familiar.

8. What size wire should be used for from zero to 100 amperes, 101 to 200 amperes, 201 to 500 amperes, and for over 500 amperes?

9. How would you change the direction of rotation of a three-phase A.C. induction motor?

10. How many volts are lost in a circuit carrying 120 amperes and having a resistance of 1/30 of an ohm? What wire size would be required for such a circuit if it were 400 feet long?

11. How would you wire four 25-ampere rheostats on a 220-volt source so as to get approximately 60 amperes at the arc?

12. Why is D.C. preferred over A.C. to supply projection arcs?

said, "regardless how it is elsewhere on the set. If color temperature in other parts of the scene is slightly up or down, it is relatively inconsequential."

Implementing the incandescent lamps were spun glass diffusers and frosted gelatins. Arnold, in preliminary photographic tests with the new Technicolor sytsem, had already established the fact that China silk diffusers often prove detrimental because of their tendency to bleach and burn, thus changing the color temperature of the light.

The sequences of tests photographed at Fox by Arthur Arling were made on three different sets. Arling's aim was to put the new system to test following customary production routine. Thus he chose scenes and setups approximating those normally used in regular Technicolor production.

Fox Tests of High Artistry

The first set was a night interior of a living room in which a girl and young man meet. The camera ranges from closeup to medium shots. The keylight registered 125 foot-candles. The action was repeated and photographed several times, each time with the illumination setup altered slightly but without changing the keylight level.

The second sequence of shots elicited considerable comment for their lighting artistry. The set was a full night interior of a bedroom with soft moonlight falling on a window at the rear. A girl on a couch, turns out the room light, arises and goes to the window where she opens the shutters, admitting moonlight. For this scene a keylight of 150 foot-candles was used. This dropped to 100 foot-candles when the room light was extinguished. An arc with four scrims was used back of the window for the moonlight effect in the closeup of the girl at the window; for the medium shot of the moonlight effect, a Senior was used with a Macbeth filter.

The third sequence was a full-lit day interior of a living room with shots ranging from medium to closeup. Here again, the keylight was 150 foot-candles.

"These initial tests," said Arling, "prove the great need at this time for a good 1000-watt CP incandescent globe. For the new Technicolor system, the present 2000-watt globes are too powerful, requiring diffusion to cut down illumination intensity. With the 1000-watt lamp we could dispense with diffusers and get correct color temperature and light intensity at the same time."

Filtering Losses Regained

"When we filter incandescent lamps for regular Technicolor," he added, "we lose 60% of the light. With the new system, using incandescent light, we gain back this lost 60% and have the advantage of the full 100% of the lamp's potential illumination. Where arcs are used with the new Technicolor system which requires use of filters, resultant light loss from filtering is around 30% —an amount easily expendable."

The test sequences photographed by Charles Boyle at U-I consisted of wardrobe and makeup tests. The takes ranged from closeups to medium shots, with an occasional two-shot, and were filmed with a keylight of 150 foot-candles. All illumination on the sets was by 2000- and 500-watt globes of 3450 K temperature. Spun glass and frosted gelatin diffusers were used. An incandescent broad was used with a silk diffuser.

Commenting upon the new system, Boyle said: "It is the most important development in Technicolor's history. After shooting Technicolor for 13 years, I just couldn't believe that such results were possible until I tried it. Working with Technicolor with a keylight of only 150 foot-candles, I just kept my fingers crossed until I saw the results. It means big things for color film production in general."

Arcs Still to Be Used

Lest it be interpreted from the foregoing that arc lighting is doomed to oblivion, insofar as color photography is concerned, it should be stated here that in the opinion of most directors of photography the general scheme for set lighting will probably be as follows for the new Technicolor system:

A—Small sets: practically all unfiltered incandescents.

B—Medium sets: unfiltered incandescents with some filtered arcs.

C—Large sets: unfiltered incandescents with a larger percentage of filtered arcs than used on medium sets.

D—The use of arcs will vary with the cameraman as at present with black-and-white photography.

As to the general availability of the new Technicolor system, the corporation is said to be aiming for full conversion to the new process within four to six months. It can handle some small Hollywood production sequences immediately.

National Carbon Reduces Copper Coating as a Defense Aid; Operating Amperage Cut

National Carbon Co. has moved swiftly to cooperate with the Government in its attempt to conserve copper for strategic defense needs, as outlined in Copper Order N.P.A. M-12, which calls for a reduction in copper for non-military needs.

In order to provide an adequate supply of carbons and, at the same time, cut copper usage, the thickness of the copper coat is being reduced in two of the most popular projector carbon trims. This action is similar to the measures taken during World War II, and these carbons will again be known as "Victory" Carbons. They will be identified by white ink showing the trade-mark and the five-ampere reduction in the maximum current rating to:

65 amperes on the 8mm-7mm trim
45 amperes on the 7mm-6mm trim

The unit package and the 5-unit case will be conspicuously labeled with the word "Victory" and will indicate the reduction in current rating.

If a "Victory" carbon is paired with a heavier copper-coated carbon, it may be necessary to make a slight adjustment in the rate of the feed to compensate for the change in burning ratio, and the maximum current marked on the "Victory" carbon should not be exceeded.

The price of "Victory" carbons is the same as that of the heavier copper-coated carbons which they replace. It is to be emphasized that, as in World War II, the supply of projector carbons will be adequate.

NPA Theater Equipment Group

A task group of six members has been appointed by National Production Authority (NPA) to study the problem of conservation of and substitution for critical materials used in the manufacture of motion picture equipment. The group, which is to report within 30 days, includes:

R. B. Tompkins, International Projector Corp., chairman; O. B. Rendahl, National Carbon; Fred C. Matthews, Motiograph; E J. Vallen, Vallen, Inc.; Leonard Satz, Raytone Screen, and Jim Elderkin, Forest Mfg.

Another task group which will offer recommendations leading to possible controls covering 35-mm equipment similar to those used during World War II, should such a move become necessary, is comprised of:

Henry Fisher, DeVry Corp.; C. S. Ashcraft, Ashcraft Mfg.; W. D. Hausler, Century Projector; H. B. Engel, GoldE Mfg.; P. F. Thomas, Altec-Lansing, and R. H. Heacock RCA. This group will also report its findings within 30 days.

TOA Stymied by FCC Inter-City Facility Deferment

ON THE same day (Jan. 10) that the Theater Owners of America called upon the FCC to give recognition to the need for the use of inter-city transmission facilities for theater video, the latter body announced the indefinate postponement of hearings on inter-city facilities which would have permitted A. T. & T. and the Tv networks to try out a recently reached agreement.

The FCC decision was a severe blow to the exhibitor body, which had entertained high hopes that an immediate start could be made on a solution to the serious problem of Tv network broadcasts inroads on theater admissions.

The exhibitor brief declared that prompt FCC action was necessary because "to do otherwise would be to deprive the public of programming which they have demonstrated a desire to have and would discriminate against the small user."

Basis of TOA Petition

TOA petitioned the FCC in August, 1949, for institution of a rule maknig proceedings looking toward the allocation of facilities for theater Tv service, declaring that "Theater Tv is a new medium (which has) potentialities of becoming one of the greatest and most important techniques" for accomplishing the declared objectives of the Federal Communications Act.

The FCC, the petitioner reminds, has always encouraged experimentation in new techniques for harnessing radio frequencies so their usage will redound to the benefit of the general public—citing frequency modulation and television—the latter in its early days "only a few years ago" when it was highly experimental, sporadic and geographically limited. The result, said TOA, was phenomenal growth of Tv.

Continuing: "Theater Tv has developed to the same point where Tv broadcasting was three or four years ago. Common carriers, by definition, cannot discriminate between the large or small or the frequent or sporadic user.

Cites Present Theater Tv

"Today there are about 15 theater Tv installations in about 10 key Metropolitan areas. The investment in this equipment is considerable, and many exhibitors are hesitant to commit themselves to the costs involved before they have some assurances that programs are available and that the means for the transmission of programs will be available at reasonable cost.

"TOA believes that the ultimate solution to the quest for a nationwide theater Tv service lies in the allocation of special frequencies for this purpose. In the meantime and until the Commission holds the theater Tv hearings and issues a decision in that proceeding, those who desire to render such a service are completely dependent upon A. T. & T. facilities.

Network Aid Minimized

"The prospects of any of the networks relinquishing time to theater Tv is even dimmer now than before. The amount of time left for theater Tv experimentation during periods which are practical in terms of theater operations is rapidly diminishing," the FCC was told.

* * *

Theater Tv for 71 Coast Houses?

News from two responsible sources indicate that serious consideration is being given to installing theater Tv equipment in more than 70 theaters on the West Coast. First, Frank Folsom, president of RCA, stated flatly that "one large theater circuit is planning for installations of video equipment in 71 theaters from Yuma, Ariz., to San Francisco."

Folsom's obviously referred to Fox West Coast Theaters, the president of which, Charles Skouras, only a few days earlier had stated that installations of Tv units in "selected showcases" would begin within six months. Negotiations are in progress for the exclusive rights to athletic and public events for theater Tv, said Skouras.

* * *

First Theater Tv on West Coast

First theater Tv showing West of Chicago was staged at the Orpheum Theater, Los Angeles on Dec. 27 last, the program fare being a half-hour show emanating from the Palladium Ballroom in Hollywood which is a regular feature of Tv station KLAC, with which the theater tieup was made.

The program was interpolated into the Orpheum's usual screen show, utilizing RCA theater Tv equipment. The Tv projector was mounted at the rear of the loge, with the control panels installed in the projection room, in accordance with the usual RCA procedure. The screen image was 15 x 20 feet.

Orpheum theater officials plan to stage periodic Tv showings over the RCA equipment, installed at a reported cost of $40,000, in an effort to gauge public reaction over a somewhat lengthy period before proceeding with other installations on the same circuit.

* * *

National Ads on RCA Theater Tv

A new twist to the RCA campaign to promote more wider use of theater Tv was the appearance in national magazines of ads extolling the benefits to be derived by the general public from attendance at theater Tv showings. Caption for the illustration showing a theater audience viewing a prizefight is: "New RCA theater television system projects 15 x 20-foot pictures of television programs."

The text below is headed: "Giant Size Television"—"Shot From a Barrel!" Then the body copy: "You've seen television. Now you'll see it in its finest form—giant projections of special events, transmitted only to theaters on private wires or radio beams to make movie-going better than ever.

Technical Data Included

"Success of the system comes from a remarkable RCA kinescope, and something new in projection lenses. The kinescope . . . is in principle the same as the one on which you see regular telecasts. But it is small—only a few inches in diameter—and produces images of high brilliance. These are magnified to 15 x 20 feet by a 'Schmidt-type' lens system like those used in the finest astronomical telescopes.

"Because of its size and shape, the new projector is referred to by engineers as the 'barrel.' It's already going into theaters, where you'll be seeing giant television—shot from a barrel."

The ad emphasizes that Tv programs in theaters will be transmitted *only* via private wires and radio beams, *not* by pickup from a regular Tv broadcast.

* * *

Radio, Tv Materiels Cutback

The radio and television producing industry has been told by the National Production Board that a major problem to-

day is a shortage of certain basic materiels. In order to assure adequate supplies of these materiels to meet defense and related requirements, NPA stated that it has under consideration limitations on the non-military use of nickel, copper, and aluminum. Tentative plans call for cut-backs in the use of these materiels up to possibly 20 or 30% below the average rate of use during an appropriate base period, which is to be determined.

NPA stressed that such a program will apply "across-the-board" to all users of the materials in their primary forms, but will in no way affect permitted consumption by product or end use. Each user affected will decide what types of products will be manufactured.

Fire Risk Due to TV Lenses

It is a well-known fact that the sun's rays, if concentrated through a magnifying lens and directed upon readily combustible material, can cause fire. An example of this has been quoted where the sun's rays, passing through a transparent plastic door handle, ignited a bath robe. Heath and forest fires have been attributed to the concentration of the sun's rays through broken glass and bottles and, today, a new medium has been introduced into daily life by means of which "insolation" (as it is called) can occur.

Radio dealers are displaying in their show windows new types of magnifying lenses for attachment to television sets. Already some incidents have occurred where insolation has set fire to the contents of radio dealers' windows where lenses are displayed.—*Fire Protection Association Journal*, July, 1950.

IA ELECTIONS

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Charles Redes, *pres.*; M. Torrey, *vice-pres.*; William Hogan, *sec.*; Frank Higgins, *treas.*; Mike J. Mungovan, *bus. rep.*

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LOCAL 105, LONDON, ONT.

S. Shaw, *pres.*; W. Hewitt, *vice-pres.*; C. Mills, *sec.-treas.*; W. Shaw, *rec.-sec.*; W. Drennan, *bus. rep.* (*projectionists*); J. Garnet, *bus. rep.* (*stagehands*); C. Mills, S. Bradford, S. Shaw, *exam. board*; W. Drennan, W. Hewitt, H. Allaster, *trustees*; W. Shaw, M. Rehder, *auditors*; C. Johnson, *sgt.-at-arms.*

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Best Wishes for a Prosperous 1951

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NEWS PROJECTIONS

RATE of Tv set production, already curtailed to some extent by major manufacturers, may be trimmed to 50% by early Spring, according to the video trade. Also, price hikes for sets are inevitable, possibly by 25%, to balance recent and anticipated excise levy. Exaples: Admiral has cut production by 10%, Olympia and Emerson by 20%, Andrea by 40%, and RCA by an undisclosed figure. . . . Mid-week closing of theaters, with operation only from Friday through Monday, are considered as likely by the TOA of New Jersey. Reason: dearth of top-flight pictures for week-long operation. . . . Zooming Govt. orders for raw film stock forecast a tight supply situation for the future. Newsreels have been using DuPont stock for some months now, following Eastman's total conversion to acetate (safety). Tv daily newsreels may have to discontinue if the shortage grows acute.

\- - -

WPIX, New York Tv station owned by the *Daily News*, now has a staff of 11 editors and photographers, plus a complete laboratory, and is broadcasting 60 regularly-scheduled news periods a week, in addition to bulletins and special features. . . . Film leaders encouraged by Dept. of Justice favoring of a voluntary arbitration system within the framework of the anti-trust consent decrees now being negotiated. . . . Madison Square Garden, New York's nationally-known sports arena, is mulling banning televising of its events, citing falling box-office receipts. Garden management would like an outlet direct to large-screen theater Tv, with its accompanying fat receipts. . . . About three-quarters of those owning Tv sets are in the broad lower and middle income brackets, comprising the great bulk of movie-going families, according to a recent Wall St. survey. . . . M-G-M, evidently undeterred by the industry-wide Tv jitters, has 32 features scheduled to roll within the next six months. Ma-

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jority of films will be in Technicolor. . . . Next major worry for the film exhibition field is possibility of a state tax on admissions, plus an *increase* in the present Federal tax.

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BRUSH-UP ON FUNDAMENTALS

(*Continued from page* 19)

to make up for the loss in capacitance it would be necessary to increase the area of the plates, thereby making a very bulky condenser.

Mica condensers of this type have been used recently in some radar equipment. They were about ten times larger than ordinary "postage stamp" mica condensers and were capable of withstanding from 2500 to 5000 volts.

The amount of voltage that a condenser can safely withstand is clearly marked thereon. These voltage ratings vary for different kinds of condensers: for mica condensers the values range from 500 to 5000 volts; for paper condensers from 150 to 2500 volts, and for electrolytics from 25 to 600 volts.

Rating of Condensers

The size of a condenser is known as its "capacitance" and the unit of capacitance is the "farad," named so in honor of the English scientist, Michael Faraday. This unit is much too large for practical work. In practical work the micro-farad (one millionth of a farad) and the micro-microfarad also called the pica-farad (one-millionth of one-millionth farad) are used. The farad is the amount of capacitance present when one coulomb of energy is stored in a dielectric field under a pressure of one volt.

Paper and electrolytic condensers usually are rated in micro-farads; while mica condensers are rated in micro-microfarads. The electrical symbol for the micro-farad is μfd, and the symbol for micro-microfarad is $\mu\mu$fd. The Greek letter μ (Mu) is used to represent the word micro.

Some manufacturers used the letter "m" in place of the Greek letter μ, so that micro-farad would be written "mfd," and the micro-microfarad would be written "mmfd." Sometimes the "d" in mfd or mmfd is omitted.

Electrolytic condensers usually are from 4 mfds up; paper condensers are from .001 mfd (1000 mmfd) to 5 mfds; and mica condensers run from 1 mmfd (.000001 mfd) up to 1000 mmfd (.001). The size is clearly stamped on paper and electrolytic condensers; and on mica condensers the size is sometimes stamped but more often it appears by means of a color code which has become standard for the industry.

The capacitance of a parellel plate condenser may be calculated by the following formula:

$$C = \frac{0.0885 \times K \times A \times (N-1)}{t}$$

Where C is the capacitance of the con-

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denser in micro-microfarads, K is the dielectric constant of the insulator between the plates, A is the area of one plate in square centimeters, N is the total number of plates, and t is the distance between the plates or thickness of the dielectric in centimeters.

Construction of Condensers

One of the most common of commercial condensers is the variable air type. This is the device you turn when you tune in a station on your radio receiver. The variable condenser consists of two sections of brass or aluminum plates, one set being free to turn and called the "rotor," and the other set being fixed and called the "stator." When the rotor is turned, the effective area of the condenser plates is changed, and this varies the capacitance. For this reason the condenser is known as a "variable" condenser.

Condensers, the capacitance of which cannot be varied at will are known as fixed condensers. A mica condenser falls under this type. This condenser consists of several plates of steel, brass, tin foil, or aluminum, each set of plates being separated by a sheet of India mica. Each alternate set of plates is connected together and two leads are brought out from the condenser. The metal and mica combination is then molded in bakelite or some other type of moisture-proof binder.

Some mica condensers are variable and are known as trimmers or padders. These condensers are not enclosed in a molded binder, and have instead a little set screw running through the plates, but insulated from them. Changing the setting of the screw brings the plates closer, or further apart, thereby changing the capacitance.

Trimmers vary in size from 5 to 50 mmfd, and padders run up to around 250 mmfd. Paper condensers consist of two plates of tin foil separated by waxed paper. In order to obtain a great deal of capacitance in a small space, the tinfoil and paper are rolled up and the resulting condenser is incased in a jacket of cardboard. Two leads are brought out—one from each plate. The ends of the condenser are covered with sealing wax to keep out dirt and moisture.

The paper dielectric is usually made up from several separate sheets of very thin waxed paper instead of just one sheet of proper thickness. This type of

TABLE OF DIELECTRIC CONSTANTS

The following is a table of approximate dielectric constants for some materials that are commonly used as insulators in condensers.

Celluloid, photographic film	6.7
Cellulose nitrate	3.8
Fiber	4.8
Fused quartz	4.0
Glass	6.5
Pyrex	4.9
Hard rubber	3.0
Isolantite	6.1
Mica, India	6.0 to 8.69
Paper	2.6
Polystyrene	2.6
Porcelain	7.0
Wood	2.5 to 6.8

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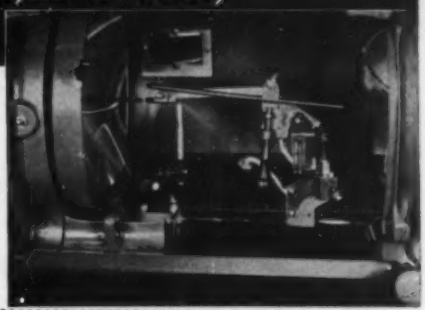

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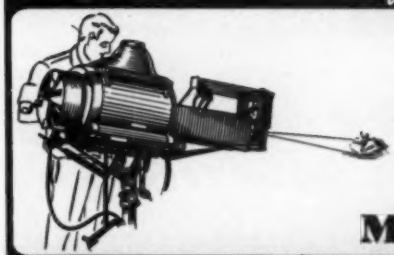

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There are two types of electrolytic condensers—wet and dry. One plate of loosely rolled aluminum which is immersed in an electrolytic solution, such as borax, is found in the wet electrolytic condenser. After a few seconds use, a thin film of aluminum oxide, and insulator, forms on the aluminum plate and acts as the dielectric. The container, which is usually made of zinc and forms a housing for the solution, forms the other plate. The aluminum is carefully insulated from the container by a strip of celluloid.

This condenser must be mounted in an upright position because of the danger of spilling the solution. Electrolytic condensers have polarity, the aluminum plate being positive, the zinc container being negative.

Proper Connection Vital

The condenser will be ruined if it is not connected in accordance with the polarity which is clearly marked or color-coded. Wet condensers can stand up under severe overloads and are self-healing after a temporary breakdown. The dry electrolytic coudenser contains an electrolyte in the form of a paste and may be mounted in any position because it can not spill. Dry electrolytics are not self-healing and must be discarded after a breakdown.

The electrolytic condenser is widely used on direct or pulsating direct currents because it contains a large amount of capacitance in a very small space. The reason for this is because the dielectric film is very thin, only a few thousandths of an inch. Dry electrolytics are usually made up in multiple sections containing as many as five condensers in one container. The negative terminal usually is common for all sections.

'MYSTERIOUS' AERIAL IMAGE

(*Continued from page* 15)

tends a much smaller angle as viewed from the lens.

The truth of the matter is that these rays are a draftsman's fabrication—they do not exist in any motion picture projector! And because these rays have no real existence, the corresponding rays between the lens and the screen (drawn with heavy lines) also do not exist.

Figure 3 is an "optical booby-trap," designed to snare the unwary. No less a personage than Century's Mr. Davee has been caught in this trap: Fig. 4 of his contribution* is based upon the same erroneous reasoning. The error in his diagram is not self-evident, however, because, to add still another mistake, the aperture was placed closer to the arc-lamp mirror than to the projection lens. The result achieved was total destruction of the angular relationships involved.

With one foot in this booby-trap, Mr. Davee places his other foot in a treacherous bog. He declares: "The light which forms the mirror image . . . is scattered and utterly lost to the motion picture screen." Being justifiably proud of the

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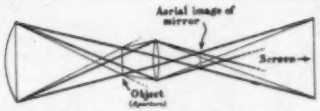

FIG. 4. The twofold optical function of the motion picture projector. Images of both the photograph on the film and the lamphouse mirror are formed simultaneously, but in different focal planes.

quality of their lenses, optical manufacturers may find this challenging statement sufficient cause for considerable eyebrow-lifting.

The foregoing discussion has demonstrated, as well as words and diagrams can tell the story, that the aerial mirror image is the orifice through which *all* light must pass on its way to the screen, where it forms a second image — the image of the film in the aperture. Discounting the effects of dust and scratches on the lens, no light is ever scattered and utterly lost to the screen!

It may be thought that the silver grains in the film emulsion effectively scatter light, thus creating rays which follow the course of the rays shown in Fig. 1. This scattering, due to both diffraction and multiple reflections, does exist; but tests indicate conclusively that the amount of light thus scattered is very much less than 0.1% of the total light flux—far too little to be visible on the screen. In fact, oil, dirt, and scratches on the film are the principle cause of this scattered light in many cases.

Technicolor prints are interesting in this connection, since the dye images are perfectly transparent, as far as freedom from diffraction effects is concerned, throughout the entire density range. Technicolor films, it may be said, scatter no light at all.

For all practical purposes, therefore, we write off scattering of light by the film as non-existant. The film can be considered as a true transparency, absorbing radiation in certain areas, but allowing more or less light to pass through other areas of the picture with unchanged direction.

A correct diagram of the light rays in motion picture projection must take into account the formation of both mirror and film images. The diagram, to be absolutely correct, must also show that all the rays which reach the screen first form the aerial mirror image—they cannot by-pass the aerial image. Also, no rays can be drawn which do not originate from some point of the mirror.

Mirror is Controlling Factor

Figure 4 is such a diagram, careful examination of which reveals that all conditions have been fulfilled and represented faithfully. Every ray picked up by the lens and projected to the screen through the aerial image can be traced back to the mirror, the sole source of illumination.

The aerial image, itself, possesses little practical importance for the projectionist in these days of rear shutters. In the old days, when front-shutter mechanisms were the rule, the aerial image was a factor to be reckoned with. By positioning the shutter in the plane of the aerial image (from 2 to 4 inches in front of the lens tube) the cutoff of the light-beam occurs at its narrowest point, hence is the most rapid cutoff possible with a front shutter. With the shutter working in the aerial image, it was

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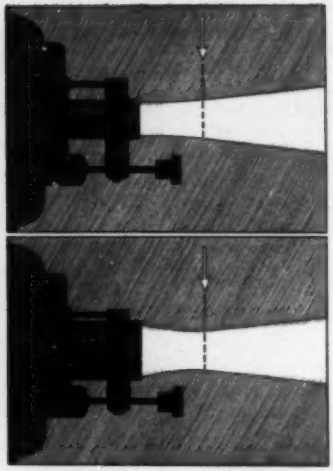

FIG. 5. The form of the light-beam when lenses of different diameters, but having the same focal length, are used. If the lens has a diameter greater than that of the aerial image, an "hourglass" constriction of the beam is produced.

possible to trim the shutter blades to their minimum width, enabling even more light to reach the screen than is possible with a single-disc rear shutter—another type of shutter now obsolete.

If the front shutter were moved out of the aerial-image plane, either toward the screen or toward the lens, travel-ghost would appear, necessitating a widening of the shutter blades in order to improve the quality of the picture. The importance of the aerial image in the positioning of front shutters is often overlooked—even by "experts."

Lens Diameter Influence

In many cases, the position of the aerial image in the light-beam is indicated by an hourglass-form of the beam. The aerial image exists in the constriction of the hourglass. In other cases, however, no such constriction can be seen—the light appears to travel out straight for a few inches, and then spread out into the familiar cone-shaped beam. Fig. 5 illustrates both cases. It is assumed in this drawing that the same lamp is used with both machines, and that the two lenses have the same focal length. The only difference is the diameter of the lenses.

The machine in the top panel of Fig. 5 utilizes a small-diameter lens. If the diameter of the lens is no greater than the diameter of the aerial image (indicated by the dotted line), no hourglass form will exist.

The lower panel shows an identical machine using a "faster" lens. Since the diameter of this lens exceeds that of the aerial image, an hourglass is distinctly seen. The aerial image here has the same diameter as that in the top panel.

Locating the Aerial Image

The aerial image may be located with great accuracy by placing a dark card square to the lens, and then moving it away from the machine, holding it in the light beam all the time. At a certain point a clear reduced image of the lamphouse mirror will be formed. The card is then in the plane of the aerial image.

Here is still another method for locating the aerial image. If the light beam is gradually intercepted and finally cut off entirely by a card moved down into the beam, the light on the screen will, of course, gradually fade out into total darkness.

Now, if the card is moved down into the beam *between the lens and the aerial image*, the light will not fade out on the screen uniformly but will be shadowed first at the bottom of the screen, the blurry shadow moving *up*. If the card is moved down into the beam *on the far side of the aerial image*, the blurry shadow will move *down* on the screen. Only when the card intercepts the beam in the exact plane of the aerial image will the light fade uniformly all over the screen's surface, the shadow moving neither up nor down.

This method of finding the aerial image may remind the reader of the so-called "flicker test" sometimes used for focusing soundhead optical tubes. The principle involved is exactly the same.

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